through an electrically conductive and magnetically permeable casing comprising the steps of:

(a) creating at least one first magnetic flux within the interior of the casing using a flux generating means;

(b) engaging the interior side of the casing with the magnetic flux without electrical contact between the magnetic flux generator and the casing for creating at least one magnetically saturated area which extends through a thickness of the casing to the exterior side;

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(c) creating at least one oscillating second magnetic flux;

(d) transmitting oscillating magnetic flux through at least one magnetically saturated area of the casing to induce eddy currents within electrically conductive media located proximate to the exterior side of the magnetically saturated casing; and

(e) using at least one receiver located inside the casing for detecting oscillating magnetic flux transmitted through the casing that is induced by the eddy currents within the electrically conductive media proximate to the exterior side of the magnetically saturated casing.

REMARKS

THE REJECTION OF CLAIMS UNDER 35 U.S.C. §112, 2nd PARAGRAPH

The Examiner has rejected Claim 17, Claims 23 through 30 and Claims 35 and 36 under §112, 2nd Paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the Applicant regards as the invention.

The Applicant has deleted Claim 17.

As to claim 23, the Examiner has stated that it is not clear how the partion of the casing is partially saturated, *the portion of the casing is either saturated or unsaturated*. (Emphasis added.)

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As to claim 24, the Examiner has stated "it is not clear how the area of casing is saturated partially and then modified so that an oscillating magnetic flux is transmitted through from either interior or exterior side of the casing. *The area of the casing is either saturated or unsaturated.*" (Emphasis added.)

The Examiner has also stated in regard to Claim 25 that "it is not clear how the shape of the partially saturated area is changed. *The area is either saturated or unsaturated.*" (Emphasis added.)

In regard to Claim 26, the Examiner again states that "it is not clear how the permeability of the partially saturated casing is modified. *The casing is either saturated or unsaturated.*" (Emphasis added.)

In regard to Claim 27, the Examiner states "it is not clear how the partially saturated casing is modified in relation to the saturation of the casing. *The casing is either saturated or unsaturated.*" (Emphasis added.)

In regard to Claims 28 and 29, the Examiner correctly notes that these claims are dependant upon Claim 23, which has been rejected for the reasons stated above, i.e, *the portion of the casing is either saturated or unsaturated.*

The Applicant understands the Examiner's objection to be based on the use of the terms "partially saturated" or "partial saturation". The Applicant respectfully notes that it has provided an explanation for these terms; that explanation being stated on pages 16 and 17 of the specification. The relevant portion of the specification is repeated as follows:

> "1. Full Saturation Magnetic Flux Circuit
>
> *The design of the saturating magnetic flux system (hereinafter "saturation circuit," or "magnetic saturation generator") allows the reduction of the permeability of the adjacent portion of casing to near 1 henry/meter. It will be appreciated by those skilled in the technology that the barrier material comprising the well casing, e.g., carbon steel, may have relative permeabilities in excess of 10,000 at a typical magnetic flux density. A fully saturated portion of the*

casing is, however, transparent to the transmission of additional magnetic flux. In this state of full saturation, the fully saturated or transparent portion of the casing can not absorb further magnetic flux. Therefore, a second and oscillating magnetic flux from the transmitter of the invention will penetrate through the transparency of the casing and into the surrounding geologic formation. ...

2. Partial Saturation Magnetic Flux Circuit

When in a state of partial saturation, the effected portion of the well casing can be used for the Magnetic Lensing focus. *Simply stated, when partially saturated, the permeability of the casing is substantially reduced, thereby allowing greater penetration by the oscillating transmitter flux, particularly at higher frequencies. However, the relative permeability of the casing is greater than 1 henry/meter. The partially saturated casing continues to absorb a significant portion of the transmitter flux. Since the casing is also electrically conductive, eddy currents are generated within the casing. Oscillating magnetic flux induced by the eddy currents is emitted from the casing into the geologic formation.* The reduced permeability can be utilized to control and concentrate this induced magnetic flux emitted from the partially saturated casing. The partially saturated casing therefore acts as a lens to concentrate and direct oscillating magnetic flux transmitted into the surrounding geologic formation. This allows measurement of the electrical resistivity of media within the formation and more distant from the well casing than can be achieved by controlling the separation distance between the transmitter and receiver.

If a partially transparent volume region is created, a separate oscillating EM wave is transmitted into this partially transparent volume region, preferably of a higher frequency than the first EM energy source. Eddy currents are generated in the partially transparent material. An oscillating magnetic flux is induced by these eddy currents. At least some portion of the magnetic flux from this induced magnetic field is transmitted out from the partial barrier material. " (Emphasis added.)

MPEP Section 2173.05 states that "(t)he meaning of every term used in a claim should be apparent from the prior art or from the specification and drawings at the time the application is filed. Applicants need not confine themselves to the terminology used in the prior art, but are required to make clear and precise the terms that are used to define the invention whereby the metes and bounds of the claimed invention can be ascertained. During patent examination, the pending clams must be given the broadest reasonable interpretation consistent with the specification. (Citations omitted.)

It is the Applicant's position that the terms "partial saturation" and "partially saturate" are sufficiently defined within the specification. The Applicant believes its use of the term partial in conjunction with saturation is not repugnant to the definition of saturation, especially in view of the believed clear statement of the intended use of the modifier "partial."

In regard to Claim 30, the Examiner states that "it is not clear how the means to control the saturation means reduces the electric power utilized." The Applicant has amended the text of Claim 30 and accordingly the Claim is believed to be allowable in its present form.

In regard to Claim 35, the Examiner states that "it is not clear what is the purpose of measuring the conductivity of the casing proximate to the logging tool in induction logging." In regard to Claim 36, the Examiner states that "it is not clear what is the need to measure the permeability of the casing proximate to the

apparatus while the casing is saturated to reduce its permeability to unity." In response, the Applicant respectfully states that the text of the specification, page 8, lines 2 through 22 explain the purpose of measuring the conductivity and permeability of the casing. Specifically, it states that knowing the conductivity and permeability allows optimization of the input frequency, amplitude and power. "It will be appreciated that these properties of the well casing (permeability and conductivity) can be expected to vary as the apparatus of the invention moves along the interior of the casing or production tubing."

The Applicant has deleted Claims 17 and amended Claims 1, 2, 4, 10, 11, 18, 22, 23, 30, 32, 33, 34, 41, 42, 43. The Applicant suggests that the amended claims satisfy the requirements of §112, 2nd paragraph. In submitting the amended claims, reference is made to MPEP Section 2173.02, which states that the examiner "should allow claims which define the patentable subject matter with a <u>reasonable</u> degree of particularity and distinctiveness. Some latitude in the manner of expression and the aptness of terms should be permitted even though the claim language is not as precise as the examiner might desire." (Emphasis original.)

The Applicant further references Section 2171 of the MPEP, noting that there are two separate requirements set forth in §112, second paragraph, i.e., (i) that the claims must set forth the subject matter the applicants regard as their invention and (ii) the claims must particularly point out and distinctly define the metes and bounds of the subject matter that is to be protected by the patent grant. However, Section 2171 expressly states the applicant is not prohibited from changing what is regarded as the invention during the pendency of the application and a "shift in claims" is permitted.

<u>THE REJECTION OF CLAIMS UNDER 35 U.S.C. §103</u>

The Examiner has rejected claims 1 through 16, 18, 31 through 37 and 43 as being unpatentable over *Gianzero et al.* U.S. Patent No. 5,038,107 (hereinafter "*Gianzero*").

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The Examiner has also rejected claims 19 through 21 under 35 U.S. C. 103(a) as being unpatentable over *Gianzero et al.* in view of *Mitchell*, U.S. Patent 5,698,982 (hereinafter "*Mitchell*").

The Examiner has rejected claims 38, 41 and 42 under 35 U.S. C. 103(a) as being unpatentable over *Gianzero et al.* in view of *Chandler et al.*, U.S. Patent 5,157,605 (hereinafter "*Chandler*").

The Examiner has rejected claims 39 and 40 under 35 U.S. C. 103(a) as being unpatentable over *Gianzero* et al. in view of *Rorden*, U.S. Patent 5,442,294 (hereinafter "*Rorden*").

Section 2141 of the MPEP states that "Patent examiners carry the responsibility of making sure that the standard of patentabiliity enunciated by Supreme Court and by the Congress is applied <u>in each and every case</u>." (Emphasis original.) "Office Policy is to follow *Graham v. John Deere Co.* in the consideration and determination of obviousness under 35 U.S.C. 103. ...(T)he four factual inquires enunciated there as a background for determining obviousness are as follows:

(A) Determining the scope and contents of the prior art;
(B) Ascertaining the differences between the prior art and the claims at issue;
(C) Resolving the level of ordinary skill in the pertinent art; and
(D) Evaluating evidence of secondary considerations."

"Accordingly, examiners should apply the test for patentability under 35 U.S.C. 103 set forth in *Graham*. .... When applying 35 U.S.C. 103, the following tenants of patent law must be adhered to:

(A) The claimed invention must be considered as a whole;
(B) The references must be considered as a whole and <u>suggest the desirability and thus the obviousness of making the combination</u>; and
(C) Reasonable expectations of success is the standard with which obviousness is determined. (Emphasis supplied.)

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Hodash v. Block Drug Co. Inc., 786 F.2d 1136, 1143 n.5, 229 USPQ 182, 187 n.5 (Fed. Cir. 1986)."

The Examiner states that *Gianzero* discloses a logging tool measuring electrical resistivity of geologic formations through electrically conductive and magnetically permeable casing comprising a first magnetic energy source; a second magnetic source; a receiver for detecting magnetic signal and a power source. The Applicant respectfully traverses the rejection above listed claims. It is the position of the Applicant that *Gianzero* does not disclose a second magnetic flux source.

The Examiner has not provided any reference where this omitted item is disclosed in *Gianzero*. Nor does *Gianzero* suggest the desireability or probable success of utilizing the second transmitter source claimed by the Applicant. It is the position of the Applicant that the *Gianzero* patent does not disclose or suggest the elements of the Applicant's invention and, indeed, teaches away from the Applicant's invention.

First, considering *Gianzero* as a whole, the cited patent clearly teaches the need for maintaining an electrical conduit between the ferromagnetic pipe casing and the device. Reference is made to Figure 2, item Nos. 45, 48, 50 and 52, all being electrically conductive materials, and Column 5, lines 42 through Column 6, line 9. Specifically, item 45 is a "core" made of material such as iron (obviously being a ferromagnetic material). Item 48 is described as radially extended whiskers for "closing the magnetic circuit" between the iron core and adjacent steel casing. Item 50 is a material such as copper (obviously an electrically conductive material) and Item 52 is a ferrite material.

In contrast, the Applicant has clearly stated that in its specification that it is a limitation of the claimed invention that there be no electrical contact between the apparatus and the well casing. See Claim 1, element (a) and Claim 43, element (b). See also page 2, line 13 through 21, of the specification. Further, the Applicant expressly cited *Gianzero* in its specification for this difference. See pages 5, 6 and

19. The Applicant also respectfully notes the text of the specification at page 54, stating as follows.

> "Additional embodiments of the apparatus may utilize means to maintain a constant distance between the apparatus and the Well Casing proximate to one or more of the Saturation Inducers. This component may be termed a constant distance control device. *This device may employ non conductive or non permeable materials to provide this contract. It will be appreciated that contact between this device and the Well Casing is not for the purpose of transmitting electrical or magnetic energy from the apparatus into the Well Casing.* The constant distance control device may also include one or more flexibly tensioned attachments, such as wheels or tracks held by springs. *These attachments may also not to (sic) be electrical conductive or magnetically permeable.*" (Emphasis added.)

Second (and again considering the patent as a whole), *Gianzero* teaches saturating or nearly saturating the well casing, an electrically conductive and magnetically permeable material, by means of a coil wound around a core material and that this same coil is use to transmit an oscillating current. (See Column 5, lines 36 – 38.) Further the *Gianzero* teaches the desirability of saturating the well casing, without regard for the desirability of inducing eddy currents within the casing or creating a controlled partial transparency that can alter the angle that electromagnetic energy is emitted from the casing. (See Column 5, line 25 – 29.) *Gianzero* is not concerned with the extent or control of the saturation of the casing. *Gianzero* teaches *more is better*. (See Column 5, line 29 – 36, stating "(a)lthough *any* suitable technique may be used to saturate the casing, it is preferably saturated in the present invention using technology such as that described with respect to FIG. 2 below, which has some features similar to that employed in self-contained

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pipeline inspection equipment, namely *massive* DC current supplied to coils near the casing." (Emphasis supplied.)

In contrast, the Applicant seeks to control the degree of saturation in order that some portion of electromagnetic energy emitted from the second side of the material crosses the material surface at a non-orthogonal angle in order that the magnetic flux component be deflected in a controlled manner due to the well known magnetic properties preventing lines of magnetic flux from intersecting. This is the Magnetic Lensing™ capacity or Magnetic Lensing effect subject of the Applicant's specification. See page 38, lines 13 – 28 of the specification. The Applicant respectfully submits that this in nowhere taught or suggested in *Gianzero* (alone or in combination with any other reference).

Gainzero teaches use of eddy currents within the formation <u>*only*</u>. (See Column 5, line 13 – 18.) In contrast, reference is made to Figures 11 – 19 of the Applicant's specification and the accompanying text appearing beginning on page 38, line 2 and continuing to page 42, line 13. See also the Applicant's specification at page 13, lines 19-25; page 17, lines 5-26; and page 21, lines 1-10.

It is therefore the Applicant's position that Claims 1 through 16, Claim 18, Claims 31 through 37 and 43 are allowable.

In regard to the rejection of Claims claims 19 through 21 as being unpatentable over *Gianzero* in view of *Mitchell*, the Applicant respectfully submits that the Mitchell does not disclose or suggest the desireability of inductive saturation of a magnetically permeable and electrically conductive casing material. This is an element which the Applicant believes is omitted from *Gainzero* as more fully set forth above. Accordingly, Applicant respectfully suggests that the combined reference of *Gianzero* and *Mitchell* does not block the patentablity of Claims 19, 20 and 21.

The rejection of claims 38, 41 and 42 as being unpatentable over *Gianzero* in view of *Chandler* is also respectfully traversed for similar reasons. It is the Applicant's position that *Chandler* does not teach the inductive saturation of a

casing. Accordingly, the combined references do not teach or suggest all of limitations of the Applicant's invention and there listed Claims should be allowed.

It is further respectfully submitted that the reference to the teaching of *Rordon* pertaining to use of geometric nulling achieved by the receiver is configured on a plane normal to the plane of the transmitter is inaccurate. Examination of the specification and accompanying drawings reveal that the receiver and transmitter are both elongated coil cylinders wrapped around highly magnetically permeable cores. Reference Figure 3 and column 4, lines 66 through 68, and column 5, line 1. Examination of Figures 1 and 5 reveal that the axis of both the receiver and transmitter coils are parallel. Therefore, the geometric null taught by the Applicants invention is not suggested by *Rordon*. The Applicant therefore requests the Claims 39 and 40 be allowed.

COMMENTS ON REMAINING REFERENCES CITED BY THE EXAMINER

The Applicant has reviewed the additional references made of record and does not believe any one of these references taken alone or in combination would inhibit the patentability of the invention of the present application.

SUMMARY

The Applicant has corrected the informalities of the specification noted by the Examiner. The Applicant has also corrected the informalities in claims 3 and 24 to conform to the Examiner's proper objections. The Applicant has also properly traversed the rejections of claims by the Examiner and accordingly, the Applicant believes the application is in order for allowance. Such action is respectfully requested

Respectfully Submitted,

Response to Office Action
Serial No. 09/781,667
Group Art Unit: 2862

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CERTIFICATE OF SERVICE

I hereby certify that this correspondence is being deposited on December 2, 2002 with the Untied States Postal Service, postage prepaid, as Express Mail – Post Office to Addressee, in an envelope addressed to the Assistant Commissioner of Patents, Box Patent Applications, Washington, D.C. 20231, Mailing Label No. .ET523636981US.

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Customer No. 36320

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VERSION OF REVISED SPECIFICATION PARAGRAPHS MARKED TO SHOW THE CHANGES

Page 31. Beginning at Line 1:

"Figure 4B is another embodiment of a single axis magnetic saturation generator ~~500~~ 501 but having two cores **551** and south poles **504**. The two north poles **505** are combined into a magnetic culminator **555**. It will be appreciated by persons skilled in the technology that the culminator must be of sufficient magnetic permeability and mass in order that it not be saturated by the saturation flux or by a combination of the saturation flux and transmitter flux.

Figure 4C is a two-axial magnetic saturation generator device ~~500~~ 501 utilizing a magnetic culminator **555**. The two-axial cross-flux magnetic saturation generator is adjacent to the well casing **110**. The four like poles **504** are connected to four separate cores **551**. The opposing magnetic poles are contained within the mass of the magnetic culminator **555**. Figure 4D is a three-axis magnetic saturation generator device ~~500~~ 501 also incorporating a magnetic culminator. The three-axis device is adjacent to the well casing **110**."

Page 32, beginning at line 21:

"Figure 6A, 6B and 6C show the geometry of the saturation flux **140** engaging the casing **110**. Figure 6C illustrates a configuration with the transmitter **300**, wound around the magnetic culminator **555**, is more centrally located in relation to the magnetic flux lines engaging or penetrating the greatest distance into the depth ~~975~~ 960 of the casing **110**. In Figure 6B, two opposing South poles are brought together or in close proximity between two North poles. The magnetic flux field lines emitted from the opposing South poles push the flux field out into the well casing **110**. However a large unsaturated volume region remains."

Page 35, beginning at line 13:

"Figure 10 illustrates another embodiment of logging tool **500** used in

conjunction with a single magnetic saturation generator to create the necessary Metallic Transparency region to practice the present invention. The logging tool **500** comprises an outer cylindrical portion ~~**202**~~ **552B** and an inner cylindrical portion ~~**204**~~**552A**. The transmitter, receiver and saturation coils are disposed on, in or around the outer cylindrical portion **552B** and the inner cylindrical portion **552A**.

Figure 10A illustrates an embodiment of a logging tool **500** used to generate a transparency with respect to a material **110** for practicing the present invention as could be adapted in Figure 10. A transmitter coil **300** is disposed at the remote end of the outside diameter of the inner cylindrical portion ~~**552B**~~ **552A** of the saturation core. A saturation coil **551** is disposed at the inner end of the outside diameter of the inner cylindrical portion **552A** of the saturation core. A receiver coil **580** is disposed within the inside diameter of the inner cylindrical portion **552A** of the core. The receiver coil **580** can be located at different positions using a shaft **232** which telescopes within the inside diameter of the inner cylindrical portion **552A** of the saturation core. The telescoping shaft **232** can also rotate using a setscrew adjustment **206** and a setscrew housing **208**. Also, wiring **234** can be channeled through the shaft **232**."

Page 41, beginning at line 20:

"Figure 16 shows two Transmitters, **300A** and **300B**, wound on separate Saturation Cores **552A** and **552B** respectively, with bucked Transparency magnets **551A** and **551B**. The Transmitters are both wound with their coils substantially parallel to the Casing **110**. The respective induced eddy currents **610** and **611** are also bucked. To deflect the Transmitting Current **150** and **151** from **300A** to the top, Transmitter **300B** should be increased in strength at the same frequency and Transparency Current of **500B** must be increase over Transparency Current of **500A**.

In Figure 17, another Transparency magnet **500C** is added to increase the current to the distance D_{23} ~~**910**~~**920**. This increase in current, will reduce the permeability of the adjacent core wall. This will bend the flux field **140-143** downward while Transmitter **300A** is made much more powerful than

Transmitter **300B** to push the flux field down. It will be appreciated that the increasing the power of the oscillating flux created by this Transmitter **300A** will result in the an increase in the induced eddy current **610** in contrast to the induced eddy current **620** of Transmitter **300B**."

Page 42, beginning at line 1

"In Figure 18, another embodiment of the invention relating to beam movement is shown. This embodiment utilizes the Transmitters **300A** and **300B** having equal diameters but oriented at 90° to the other. The oscillating magnetic flux of each transmitter will induce eddy currents **610** and **611** in the electrically conductive casing **110** also oriented 90° to the other. Again, it is possible to use combination of transmitter and Magnetic Transparency Generator's **500A** and **500B** having unequal saturation strengths to bend **956** the flux field **140 and 141**."

Page 47, beginning at line 18:

"In Figure 22, the bistatic logging tool **500** consists of two separate magnetic saturation generators **593** and **595** contained within a housing ~~**109**~~**572**. The magnetic saturation generator **593** incorporates a receiver with a receiver coil **581** wound orthogonal to the saturation coil **551**. The magnetic saturation generator **595** incorporates a transmitter **300** with the transmitter coil **301** wound parallel to the saturation coil. The distance between the receiver coil **581** and the transmitter coil **301** is the distance "D" **910**. The logging tool **500** is in operative association with a well casing **110** having a defect **599A**. It can be appreciated by those skilled in the art that in the bistatic configuration illustrated in Figure 22, the distance D must be sufficiently small relative to the geometric size of the defect **599A** in order that the logging tool may detect the defect. Accordingly, the accuracy of the casing thickness calculation is limited by the mass to be evaluated and the displacement distance "D" **910**."

Page 49, beginning at line 12:

"FIG 5C illustrates one embodiment of the logging tool **500** of the present invention. The logging tool **500** comprises the saturation coil **551**, the transmitter coil **300**, receiver coil **580** and the well casing **110**. The magnetic saturation generator **501** is disposed from the well casing **110** by a gap G ~~150~~950. The well casing **110** has a thickness L ~~160~~960. The logging tool **500** operates by energizing the saturation coil **551** for saturating the well casing **110**, transmitting a transmitter flux from the transmitter coil **300**, and receiving a response via the receiver coil **580**. The relative penetration is caused by the change in the saturation flux. Thus, as the saturation flux increases from i_1, to i_2, to i_3, to i_4 then the penetration depth increases from δ_1, to δ_2, to δ_3, to δ_4, respectively. Figure 5C illustrates the incremental increase in penetration by the field lines F_1, F_2, F_3 and F_4. Also, consideration of the cross-sectional area of each component of the logging tool **500** is required to assure that no component goes into total saturation for a specific power requirement necessary to drive the magnetic flux across the gap G **950**."

Page 51, beginning at line 8:

"Figure 25 is a graph of amplitude versus time for a bistatic configured magnetic saturation generator of the present invention. The frequency is held constant (fixed) and the barrier material, also of constant thickness, and is varied. The bistatic magnetic saturation generator was nulled using copper **902**. Thereafter, the copper was replaced with brass causing the amplitude to vary from the original nulled position **904** to a new position ~~904~~906. Since brass and copper have related properties, the dislocation 904 from the copper nulled position **902** is small. However, when the brass is replaced with aluminum the amplitude 906 varies significantly from the original nulled position **902**. Aluminum and copper have significantly different physical characteristics. "

VERSION OF AMENDED CLAIMS WITH MARKINGS TO CHANGES MADE

1. (AMENDED) A logging tool for measuring electrical resistivity of geologic formations through an electrically conductive and magnetically permeable well or bore hole casing comprising:

(a) a ~~saturating means~~saturation inducer for (i) generating a first magnetic flux, and (ii) engaging the magnetic flux with a portion of the casing without ~~physical~~ electrical contact between the saturating ~~means~~ inducer and the casing, for (iii) creating at least one magnetically saturated portion of the casing extending through the thickness of the casing ;

(b) a transmitter ~~means~~ for generating and transmitting an oscillating second magnetic flux through the saturated portion of the casing; and

(c) a receiver ~~means~~ for detecting ~~the~~ an oscillating magnetic flux transmitted from the exterior of the saturated portion of the casing.

2. (AMENDED) The apparatus defined in claim 1 wherein the transmitter ~~means~~ and the receiver ~~means~~ are proximate to the saturated portion of the casing.

4. (AMENDED) The apparatus defined in claim 3 further comprising at least one housing to contain the ~~saturating means~~saturation inducer, the transmitter ~~means~~ and the receiver ~~means~~.

10. (AMENDED) The apparatus defined in claim 1 further comprising at least one means separately located from the ~~saturation means~~saturation inducer, transmitter ~~means~~ and receiver ~~means~~ for receiving an electrical signal

corresponding to the oscillating magnetic flux detected by the receiver ~~means~~ and connected to the receiver by means to transmit such electrical signal.

11. (AMENDED) The apparatus defined in claim 10 further comprising ~~means to~~an output display for the received electrical signal and the location of the receiver in the axial length of the casing.

17. (Deleted) ~~The apparatus defined in claim 16 further comprising means to move the housing within the casing without mechanical attachment to a separately located control.~~

18. (AMENDED) The apparatus defined in claim 1 wherein at least one of the transmitters is located proximate to the saturation ~~means~~ inducer and at least one receiver ~~means~~ is located proximate to another saturation ~~means~~inducer.

22. (AMENDED) The apparatus defined in claim 1 wherein a plurality of saturation ~~means~~inducers, transmitters ~~means~~ and receivers ~~means~~ are ~~horizontally~~ oriented in different directions radially from the axial length of the casing.

23. (AMENDED) The apparatus defined in claim 1 wherein (i) the saturation ~~means~~ inducer engages the interior side of the casing with magnetic flux but does not saturate the casing through to the exterior side, (ii) the oscillating magnetic flux generated and transmitted by the transmitter means induces eddy currents within the partially saturated portion of the casing, (iii) receiver ~~means~~ detects oscillating magnetic flux generated within electrically conductive media located exterior to the casing by eddy currents induced within the media by the oscillating magnetic flux emitted from the partially saturated casing.

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26. (AMENDED) The apparatus defined in claim 23 further comprising means to modify the relative permeability of the partially saturated casing.

30. (AMENDED) The apparatus defined in claim 23 wherein the amount of electric power utilized by the saturation inducer can be variably controlled ~~means to control the saturation means reduces the electric power utilized by the saturation means~~.

32. (AMENDED) The apparatus defined in claim 1 wherein the saturation ~~means~~ inducer and the transmitter ~~means~~ utilize the same electrically conductive coil.

33. (AMENDED) The apparatus defined in claim 1 wherein the saturation ~~means~~ inducer utilizes a dc electrical power and the transmitter ~~means~~ uses ac electrical power.

34. (AMENDED) The apparatus defined in claim 1 wherein the saturation ~~means~~ inducer comprises a permanent magnet.

41. (AMENDED) The apparatus defined in claim 33 wherein the transmitter ~~means~~ and receiver ~~means~~ are separated by magnetically unsaturated material.

42. (AMENDED) The apparatus defined in claim 38 wherein the transmitter ~~means~~ is placed upon a material having sufficient mass and magnetic permeability to direct the transmitter flux in a manner to minimize the quantity of transmitter flux reaching the receiver ~~means~~.

43. (AMENDED) A method for detecting electrically resistive media within a geologic formation by transmitting and receiving magnetic flux through

an electrically conductive and magnetically permeable casing comprising the steps of:

(a) creating at least one first magnetic flux within the interior of the casing using a flux generating means;

(b) engaging the interior side of the casing with the magnetic flux without ~~physical~~ electrical contact between the magnetic flux ~~generating~~ generator ~~means~~ and the casing for creating at least one magnetically saturated area which extends through a thickness of the casing to the exterior side;

(c) creating at least one oscillating second magnetic flux;

(d) transmitting oscillating magnetic flux through at least one magnetically saturated area of the casing to induce eddy currents within electrically conductive media located proximate to the exterior side of the magnetically saturated casing; and

(e) using at least one receiver ~~means~~ located inside the casing for detecting oscillating magnetic flux transmitted through the casing that is induced by the eddy currents within the electrically conductive media proximate to the exterior side of the magnetically saturated casing.